MASTER OF SCIENCE
IN
APPLIED MATHEMATICS

MATRIX ALGEBRA
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This thesis is designed to act as an instructor's supplement for the Naval Postgraduate School's (NPS) refresher matrix algebra courses. The need for a beginning matrix algebra supplement is driven by the unique circumstances that a majority of NPS students find themselves. Most military students attend NPS several years after receiving their undergraduate degrees. This supplement, unlike most college textbooks, bridges the gap between the student's educational lay-off and the rigors of mathematically oriented degrees such as applied math, operations research and engineering. By reviewing the fundamental concepts of vectors and matrices, and computationally performing operations on them, the student quickly develops the requisite knowledge to succeed in NPS' demanding curriculums. This supplement focuses on matrix and vector operations, linear transformations, systems of linear equations, and the techniques required to computationally solve systems of linear equations. The goal of this thesis is to enhance current textbooks and help the beginning student in matrix algebra in order to build a foundation for higher level engineering and mathematics based courses.

DoD KEY TECHNOLOGY AREA: Other (Matrix Algebra Supplement)

KEYWORDS: Matrix Algebra

AN EXAMINATION OF BI-ORTHOGONALITY RELATIONSHIPS IN ELASTIC-FLUID MEDIA
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The bi-orthogonality relationships for vertically heterogeneous porous media in contact with various surfaces have been previously established. For the special case in which the porous substance has zero porosity, the relationships reduce to those for elastic media. The biorthogonality relationship for a fluid loaded elastic slab will be considered numerically by discritizing the boundary value problems using finite differences. The resulting matrix will be analyzed for the purpose of

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determining eigenvalues of the complex dispersion relationship of the layered media, as well as discerning the corresponding eigenvectors which are discrete analogies of the propagation/evanescent eigenfunctions of the media.

DoD KEY TECHNOLOGY AREA: Other (Acoustics, Mathematics)

KEYWORDS: Acoustics, Bi-orthogonality, Elasticity

DEVELOPMENT OF A TEST MECHANISM FOR ANALYZING FORCE ATTRITION METHODOLOGIES WITHIN AGGREGATED COMBAT SIMULATIONS

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For aggregated combat simulation models, the methods for calculating force attrition must be based upon sound mathematical formulations and parameter estimations. With an inherent lack of representative combat data for modern warfare scenarios, one effective method for determining the required parameter estimates is to thoroughly analyze the output from a stochastically based high-resolution combat model. It is this development of attrition parameters process, which so profoundly influences the validity of aggregated simulations, that lacks any comprehensive documentation or mathematical justification within the modeling community. By examining the development and validity of these processes for parameter estimation, valid attrition calibration formulae can be determined and used within force attrition algorithms in order to more precisely and justifiably model aggregated combat operations. The establishment of a user-friendly test bed for examining this attrition rate development process will play a major role in solidifying the understanding, implementation, and validation of current and future process techniques.

DoD KEY TECHNOLOGY AREA: Modeling and Simulation

KEYWORDS: Combat Modeling, JANUS, Simulation, Attrition, ATCAL